Amira Software: Supporting Distinct Stages of Pharmaceutical R&D

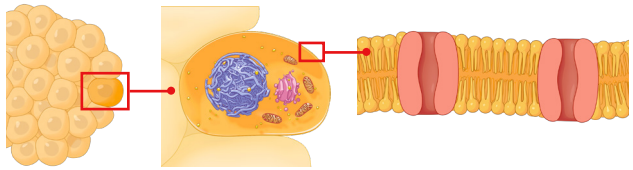
From target discovery to pre-clincal development

thermo scientific

Pharmaceutical research and development takes many forms and has many stages. The journey from target discovery and compound identification to pre-clinical development to an eventual market-ready product requires a broad range of analytical capabilities. The highly versatile Thermo Scientific™ Amira™ Software delivers such a range. It is a multifaceted software solution that offers native compatibility with an abundance of imaging modalities, while also offering customizable workflows and deep learning capabilities. Amira Software provides a dynamic toolbox to work with life science research data from multiple image modalities, including light microscopy, electron microscopy, high-content screening, X-ray, CT, PECT, MRI, and ore. No matter what stage your research is in—biological target validation, lead compound optimization, or anywhere else along the path to market—Amira Software can provide the support you need.

How Amira Software supports distinct stages of pharmaceutical research and development

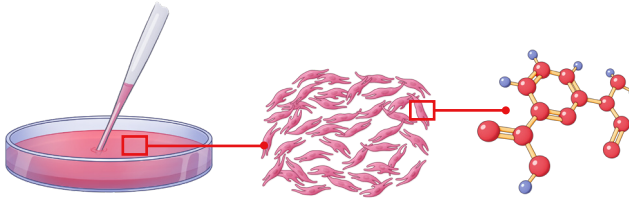
From organic molecules to tissues, Amira Software provides a broad range of segmentation and visualization of wide-ranging imaging data. Below are some categories and sub-categories of Amira Software's applications for life sciences.



Biological target discovery and validation

Where Amira Software can be used for target characterization and "druggability" validation:

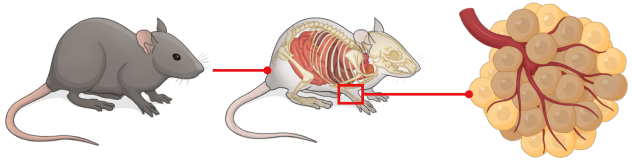
- **Cell morphology**
- **Cellular target localization**
- **Cell viability**
- **Cell dynamics**



Lead compound identification and optimization

How Amira Software is used for lead compound validation for safety and efficacy:

- **Analysis of drug characteristics**
- **Drug particle distribution**
- **Molecular structure**
- **Toxicity studies through cell viability testing**



Preclinical development

How Amira Software can visualize data for *in vivo* and *ex vivo* testing in animal models:

- **Structural anatomy of small animal models**
- **Bone, skeleton structure analysis**
- **Soft tissue / tumor characterization**
- **Tumor localization, growth**

Biological target discovery and validation overview

Amira Software can be trained to evaluate the "druggability" validation of a specific disease and can target that disease during its segmentation and visualization. The software can be taught to sift out irrelevant samples, which then enables researchers to carry out more relevant analyses on a larger number of in vitro assays and perform imaging of 2D or 3D cell models.

At the intercellular level:

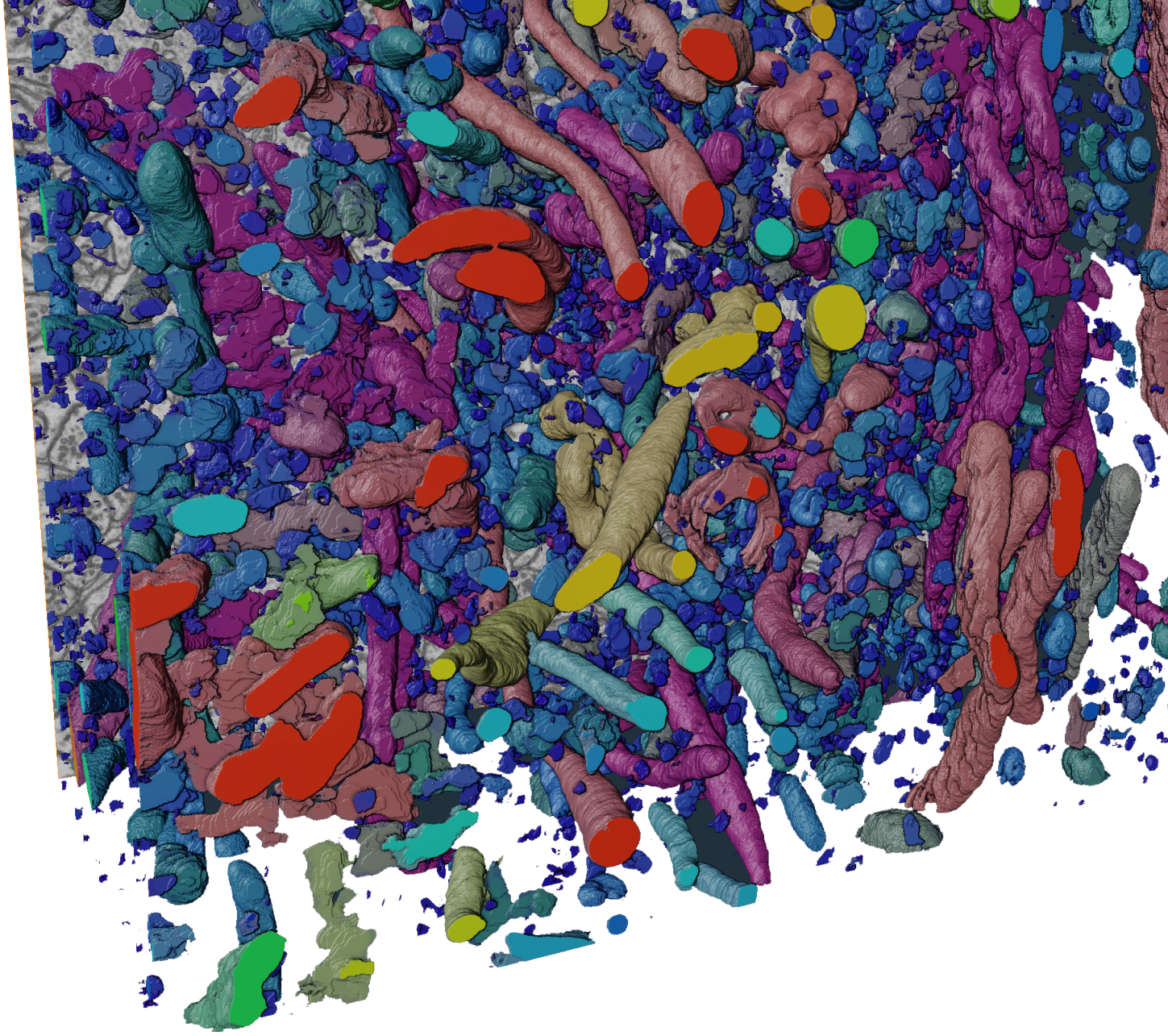
- Cell viability (or its apoptosis or cell count)
- Cell dynamics (their proliferation and migration)
- Spatial cell distribution

At the intracellular level:

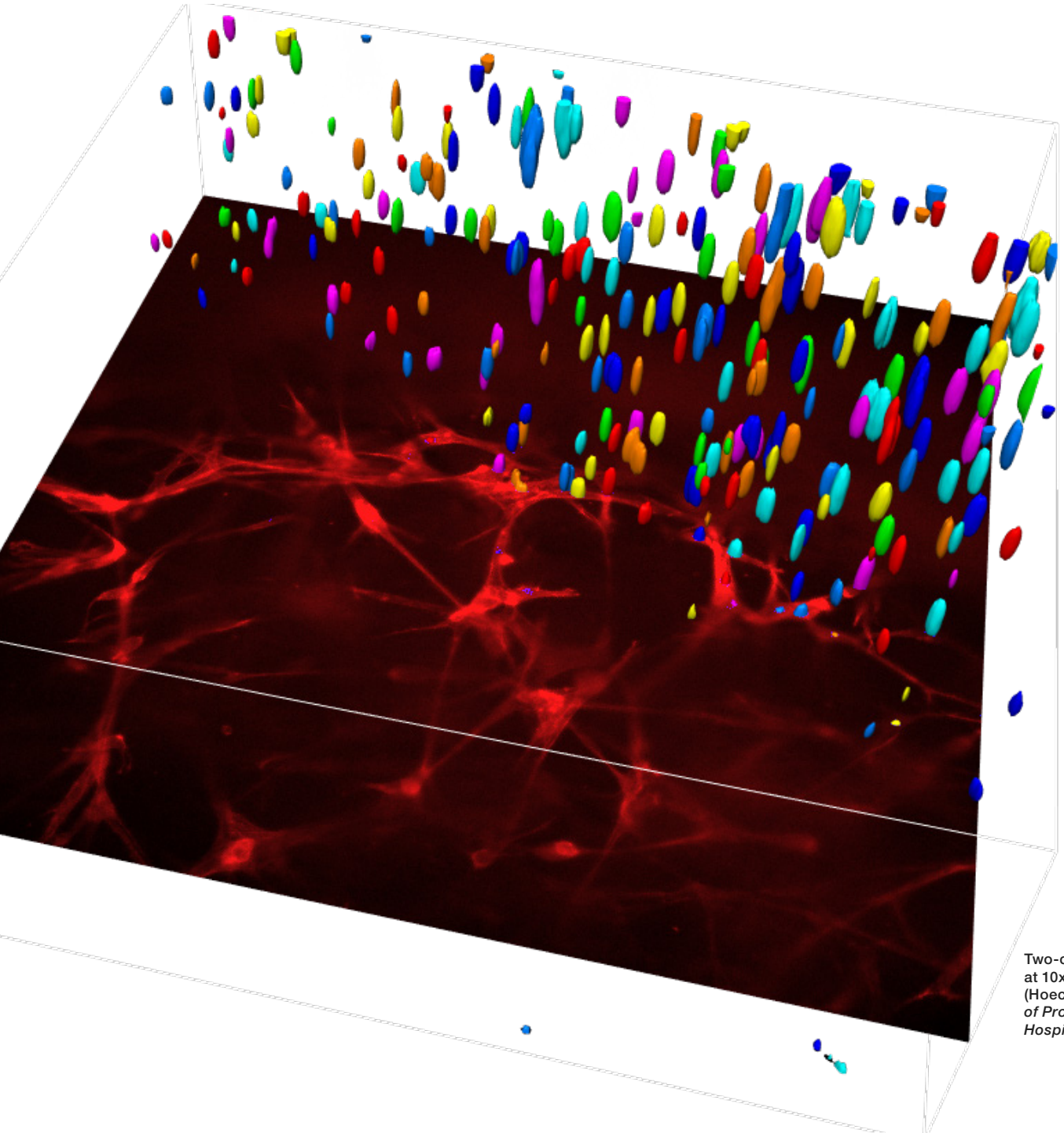
- Cell morphology (size, shape, volume)
- Organelle detection and count
- Cellular target localization (its biomarker expression)

At the molecular level:

- Molecular surface analysis of cells
- Membrane porosity



EPFL FIB-SEM dataset of a mouse brain imaged at 5nm^3. Image shows detection and segmentation of mitochondria using trained deep learning models within Amira 3D Pro. *Data courtesy of Graham Knott and Marco Cantoni at EPFL.*



Identifying and optimizing lead compounds

Identifying the lead compound's validation, optimization, and efficacy is imperative at the pre-clinical stage to assess a drug's effectiveness and potentially tweak a compound for any unintended side effects. Determining a drug's structure early on can ensure that it will act as intended on the tested animal model(s).

Capabilities of 2D-3D molecular analysis for compound characterization and validation:

- Analysis of drug characteristics (structure, stability, etc.)
- Drug particle distribution (in cell)
- Molecular structure and surface imaging
- Toxicity studies through cell viability testing (apoptosis, count)
- Cell dynamics (proliferation, migration, localization)
- Cell morphology (cytoskeleton)

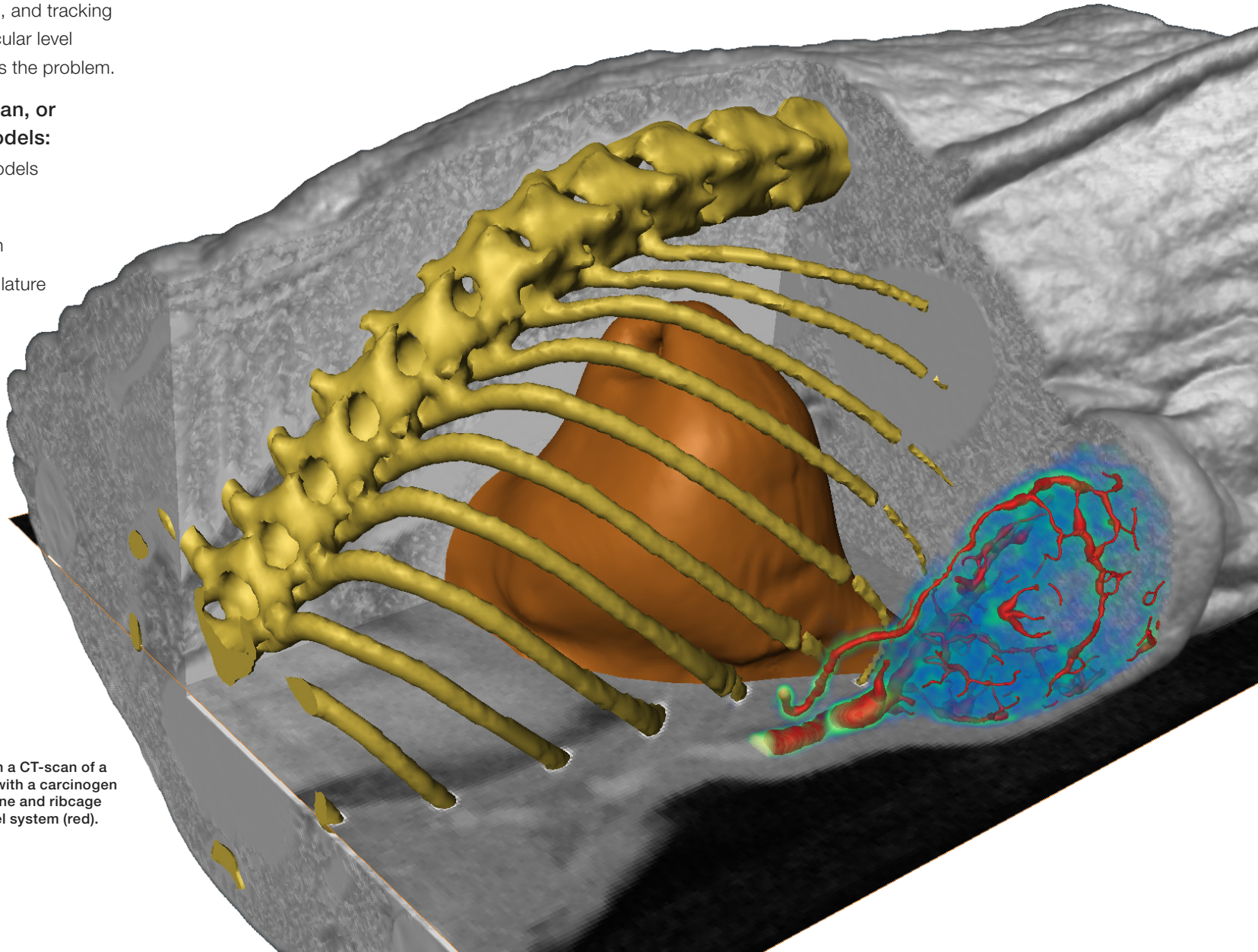
Two-channel sample imaged on a Thermo Scientific CellInsight CX7. Data captured at 10x magnification, 100 z-slices at 4 micron spacing. Two stains consist of DNA (Hoechst) stain and an Actin stain (Phalloidin) for the cytoskeleton. *Data courtesy of Prof. Dr. med. Caroline Ospelt, Center of Experimental Rheumatology, University Hospital of Zurich.*

Preclinical development

Observing the intended effects and potential side effects during the pre-clinical stage of drug development determines whether the tested drug is safe for human ingestion and performs as intended. Using the proper software to assist in mapping, monitoring, and tracking these effects from the tissue to the molecular level ensures that fixes in these stages address the problem.

2D-3D *in vivo* or *ex vivo* tissue, organ, or full organism analysis in animal models:

- Structural anatomy of small animal models
- Bone, skeleton structure analysis
- Soft tissue and tumor characterization
- Tumor localization, growth, and vasculature
- Bone, skeleton structure analysis
- 3D vascular microenvironment

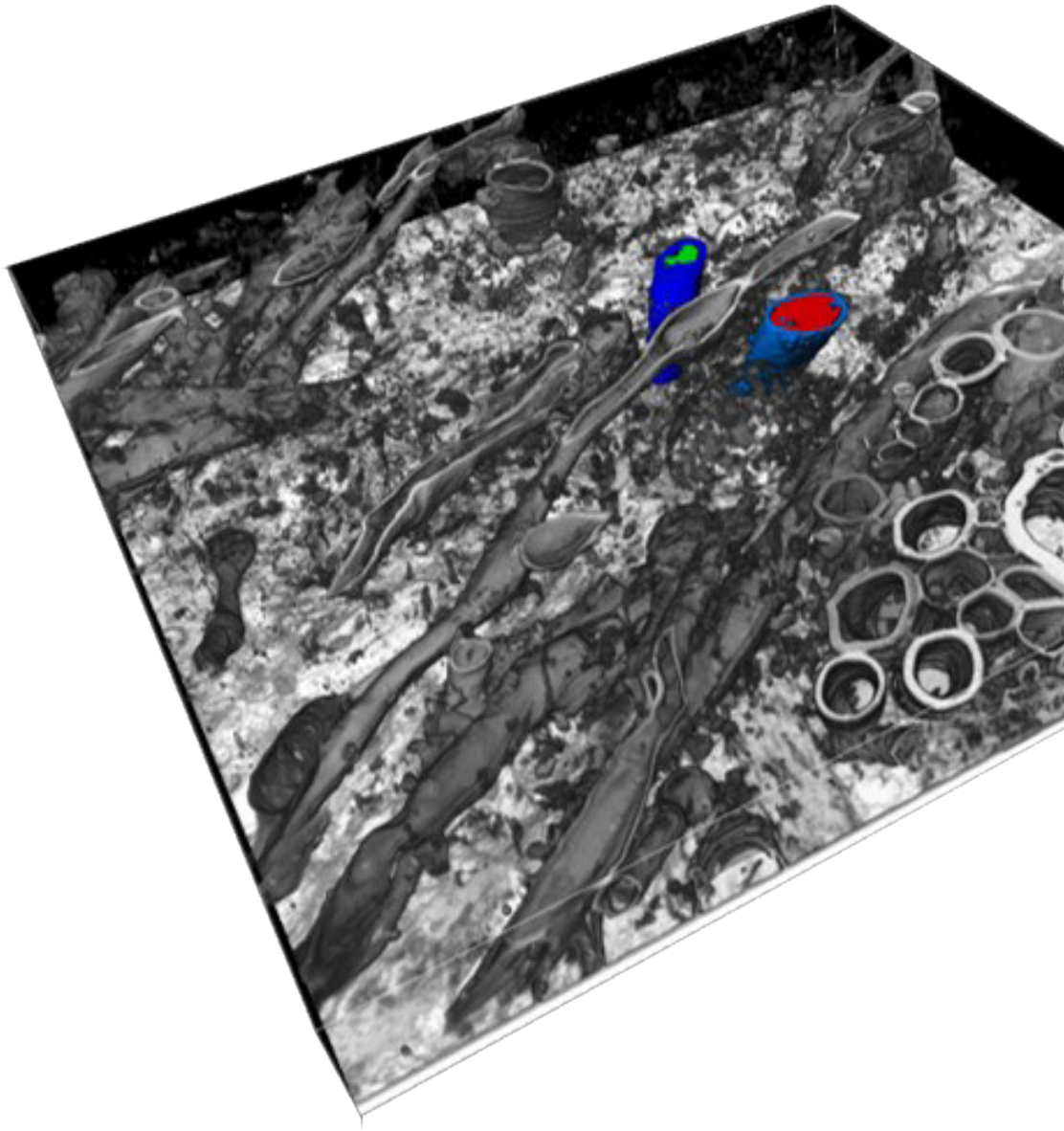


Volume rendering of the reconstruction based on a CT-scan of a mouse which has been treated subcutaneously with a carcinogen agent to induce the growth of a tumor (gray). Spine and ribcage (yellow); liver (orange); Tumor (blue); Blood vessel system (red). *Data courtesy of Dr. Elizatea Stepina and Dr. Peter Hauff, Bayer Healthcare.*

In summary

Thermo Scientific Amira Software is a comprehensive imaging analysis toolbox for pharmaceutical and life science researchers, capable of providing support throughout all stages of the research and development process. Amira Software allows researchers to **push the limits** of their data imaging analysis, giving them the ability to accurately analyze their quality findings with unparalleled resolution at almost any scale.

The software toolbox can be trained to sort through irrelevant samples to assure focus on more pertinent analyses in early stages of discovery. In later stages, it can provide a broad range of segmentation and visualization of wide-ranging imaging data, allowing for detailed analysis of everything from organic molecules to tissues. Whether you are in the initial stages of target characterization, further along in identifying and optimizing lead compounds, or observing effects during preclinical trials, Amira Software is ready to support you through all the distinct stages of the entire research journey their findings to advance research for breakthrough drug discoveries.



Learn more at **thermofisher.com/AmiraDrugDiscovery**